MAGNOLIA POWER PROJECT
APPLICATION FOR CERTIFICATION
RESPONSE TO CEC DATA REQUESTS
01-AFC-06

Technical Area: Air Quality

Data Request 1 Rev: During the CEC Data Request Workshop on November 13, 2001, staff indicated that their air analysis has primarily focused on the General Electric (7FA) and that CEC processing delays may be encountered if the project decides to use a Westinghouse (501 F) turbine. CEC staff requested the applicant to commit to a specific turbine vendor.

Response: The AFC and subsequent data responses are based on "worst case" emission estimates such that environmental impacts (regardless of the turbine selected) will be equal or less than the analyzed impacts. The air quality emission estimates, dispersion modeling analysis and offsets are all based on worst case estimates. Therefore, if the CEC bases their analysis on the applicant provided information there should be no need for significant additional impact analysis regardless of the turbine selected and CEC delays should not be encountered. The applicant anticipates that a specific turbine vendor will be selected mid- December and will inform CEC as soon as the selection is made.

The applicant has only provided SCAQMD permit fees for a single unit. The SCAQMD has indicated that additional fees will need to be paid if the Westinghouse turbine is selected. Submittal of additional fees is not anticipated to have a significant impact on predicted impacts or air quality compliance of the facility. Therefore, selection of the Westinghouse turbine is not anticipated to warrant a significant delay in SCAQMD permit processing.

Technical Area: Air Quality

Data Request 3 Rev: The initial response to data request 3 utilized a study performed by Ecodyne Cooling Products (Wistrom and Ovard 1973) which concluded that only 31.3% of the total drift mass from the cooling tower would disperse into the atmosphere. During the data adequacy workshop CEC staff indicated that they are concerned that the study data may not be representative of the MPP facility operations, since the cooling tower drift in the study was at a higher rate then the proposed MPP.

Response: Initial cooling tower emissions calculated for the MPP were (submitted with the AFC) based on 1.3 cycles of concentration assuming all dissolved solids from the cooling tower were emitted as PM_{10}. Since that time, the cycles of concentration have been increased to 5.6 and additional data have been obtained which would more realistically estimate PM_{10} emissions from the cooling tower. On November 5, 2001, revised emissions and a revised modeling analysis were submitted to the CEC. The revised emission rates were based on the percent of cooling tower drift that could be atmospherically dispersed. The study was performed by Ecodyne Cooling Products (Wistrom and Ovard 1973). This study concluded that 31.3 percent of the drift from a cooling with a 0.001 percent drift rate was atmospherically dispersible.

Since the November 5, 2001 submittal, further information has been obtained. An analysis performed for Blythe Energy utilized water droplet size distribution data for a cooling tower with a 0.0003 % drift rate. These data were obtained from Brentwood Industries, a drift eliminator manufacturer, and were based on data from an Electric Power Research Institute (EPRI) test cell in Houston Texas. The droplet sizes were presented as droplet diameters. Please note that a droplet size distribution based on a drift rate of 0.0003% would produce smaller droplets than the drift rate of 0.0006% proposed at the MPP. Therefore, the size distribution data are conservative when applied to the MPP. The droplet size information is presented in Table AQ-1.

As described in the analysis performed for Blythe Energy, the following assumptions were made:

- When a droplet is emitted into the atmosphere, it is assumed to evaporate into a single spherical particulate.
- The water droplet density is assumed to be 1.0 gm/cm^3 or 1.0E-06 µg/µm^3.
- The density of the particles is assumed to be 2.2 gm/cm^3 or 2.2E-6 µg/µm^3 (sodium chloride).

The droplet size diameters presented in Table AQ-1 were initially converted to spherical volumes as shown in equation (1). The volume of the mass of water was calculated using the water density information data listed above. The total dissolved solids (TDS) for each size category was then used to calculate the mass of solid matter. The volume of solid matter for each size category was calculated using the density of sodium chloride. Equation (2) summarizes the methodology. Finally, the particle size diameters were determined by applying the relationships assumed above.

(1) $V = (D/2)^3 * 4\pi/3$

(2) $D_p = 2 * {}^3\sqrt{(D_d/2)^3 * (\rho_w / \rho_s) * (TDS)}$

$D_p = 2 * {}^3\sqrt{(D_d/2)^3 * (1.0/2.2) * (4{,}032) / 10^6}$

Where:

D_p	=	particulate diameter
D_d	=	droplet diameter
ρ_w	=	1.0 gm cm3 (density of water)
ρ_s	=	2.2 gm cm3 (density of solid)
TDS	=	720 ppm * 5.6 cycles = 4,032 ppm (TDS)

Table AQ-1 also summarizes the estimated droplet volumes and particle diameters. As shown by interpolation, 38% of the droplet mass is represented by particle diameters equal to or less than 10 µm. Revised cooling tower emissions (Table 2) have been calculated using the assumptions described above, and those accepted for Blythe Energy. Final cooling tower emissions listed in the Commission Decision Application for Certification BLYTHE Energy Project (CEC March 2001) are those calculated using this methodology.

The MPP has provided two separate methodologies for refining cooling tower emissions. Both methods indicate a distribution of 30 to 40 % of the cooling tower drift is atmospherically dispersable. The use of the EPRI methodology would result in total cooling tower emissions slightly higher than those presented in the November 5, 2001 submittal. Therefore, modeling was revised based on the emissions presented in Table AQ-2. Revised modeling results (including turbines) are presented below in Table AQ-3. As shown, the MPP is still below the PSD and SCAQMD significant impact levels.

TABLE AQ-1

Magnolia Power Project

Revised Cooling Tower Emissions[1]

Size Catagories from EPRI Data Droplet Dimater (μm) Low	Hi	Droplet Volume (μm^3)[2]	EPRI % Smaller	Particle Diameter (μm)
10	20	524	0.000	1.224
20	30	4189	0.196	2.448
30	40	14137	0.226	3.671
40	50	33510	0.514	4.895
50	60	65450	1.816	6.119
60	70	113097	5.702	7.343
70	**90**	**179594**	**21.348**	**8.566**
90	**110**	**381704**	**49.812**	**11.014**
110	130	696910	70.509	13.461
130	150	1150347	82.023	15.909
150	180	1767146	88.012	18.357
180	210	3053628	91.032	22.028
210	240	4849048	92.468	25.699
240	270	7238229	94.091	29.370
270	300	10305995	94.689	33.042
300	330	14137167	96.288	36.713
330	400	18816569	97.011	40.384
400	450	33510322	98.340	48.951
450	500	47712938	99.071	55.070
500	600	65449847	99.071	61.188
600	700	113097335	100.000	73.426

Assumed TDS	720	ppm
Cycles of conc.	5.6	
CT TDS	4032	ppm

38.021

[1] Based on Electric Power Research Institute (EPRI) test cell in Houston, Texas for a 0.0003% drift fraction.
[2] To be conservative, the droplet volumes were calculated based on the low end of droplet diameter range.

Table AQ-2
Cooling Tower Emission Rates

Drift rate	900	gpd
Inlet water TDS	720.00	mg/L
Cycles of Concentration	5.6	
Cooling Tower TDS	4032.0	mg/L
Correction Factor[1]	0.3802	
Emissions	0.0604	g/s
Emissions per cell	0.010075	g/s

[1] Ecodyne Cooling Products Division
G.K. Wistrom and J.C. Ovard.

Table AQ-3
PM10 Concentrations

Maximum 24-hour Average[1]	2.458	$\mu g/m^3$
Annual Average	0.252	$\mu g/m^3$

Technical Area: Air Quality

Data Request 6 Rev: During the November 13, 2001 Data Adequacy Workshop the CEC staff expressed concern that the exhaust profile data used for construction modeling may not be representative of actual conditions, since the data used was based on 100 % load conditions. CEC staff indicated that they felt partial load conditions with lower exhaust and temperature profiles should be used.

Response: URS provided conservative data based upon published manufacturer data at 100 % load and California Air Resources Board Guidance. The use of full load emissions is anticipated to over-predict total construction emissions. This same approach has been utilized for several other CEC licensed facilities, including the Pittsburg District Energy Facility (aka Los Medanos Energy Facility) and the Pastoria Energy Facility. As indicated in the data response submitted on Novemeber 5, 2001 over the range of Caterpillar engines, the calculated exit velocities ranged from 44 m/s to 74 m/s for low rpm (peak torque) operations, to 75 m/s to 94 m/s for operations at rated rpm's, based on an exhaust temperature of 660^{o}F. For the purposes of calculating dispersion from all construction equipment, MPP used a conservative estimate of 40 m/s. Also as noted in our previously submitted data response, for "prime engines" (examples include compressors, cranes, generators, pumps, grinders, and screening units) the exhaust temperature for a 420-hp engine is given as 739^{o}K (870^{o}F). This exhaust temperature is consistent with exhaust temperatures found on the Caterpillar website for larger diesel-fired generator units. Therefore, it is believed that typical exhaust temperatures from diesel-fired construction equipment should actually exceed the MPP assumed exhaust temperature of 700^{o}F. Increased exhaust temperatures would also increase the exit velocities and likely reduce impacts.

The applicant agrees that there could be occasion when the construction equipment may operate at partial loads, however it would be speculative at best to try to assign a load profile to the construction equipment. The use of full load data has been approved by the CEC for several other projects and the applicant has no knowledge of why the MPP project should be treated differently. Further, the applicant has agreed to stipulated conditions of certification that are designed to mitigate construction impacts and the implementation of the mitigation measures are anticipated not to be altered regardless of the exhaust profiles used in the analysis.

Technical Area: Air Quality

Data Request 7 Rev: During the November 13, 2001 Data Adequacy Workshop CEC staff indicated that they needed exhaust parameters for each commissioning event to verify that the modeling results represent worst case conditions.

Response: URS believes that a reasonable worst case analysis has been performed for the turbine commissioning process. As stated during the workshop, commissioning events can only be generally predicted and it is not possible to dictate the specific exhaust profiles that will be achieved during commissioning. However, Black & Veatch has provided the following further commissioning information for the CEC consideration.

The stack exhaust flows and temperatures at the average expected plant loads during the commissioning period are listed below. The data are based on steady state conditions at 95 F and on the expected average load that corresponds to each commissioning event. Note that during each commissioning event the plant is frequently operated at different loads and in transient states. The standard deviation from the average load is expected to be up to 50%. Therefore, the stack emissions, exhaust flow and temperatures are expected to vary significantly during each commissioning event and the accuracy of this estimate is to be considered low. Attached Table AQ-4 provides the best estimate of commissioning exhaust parameters.

SCPPA Magnolia Power Project
Total Emissions Estimates for Commissioning, Rev.1
B&V project 99523.0150
November 16, 2001

Transient Operation

Startup Task	Total CC Starts per Task			Total NOx Emissions per Start, lbm			Total CO Emissions per Start, lbm			Total VOC Emissions per Start, lbm			Total PM10 Emissions per Start, lbm			Total SO2 Emissions per Start, lbm		
	Cold	Warm	Hot	Cold	Warm	Hot	Cold	Warm	Hot	Cold	Warm	Hot	Cold	Warm	Hot	Cold	Warm	Hot
1st Seven Weeks																		
1 First Fire	1			296.3	16.9	16.0	609.7	245.8	231.4	56.0	35.0	33.0	36.6	2.7	2.6	0.58	0.03	0.06
2 Install SCR Catalyst		1		430.3	226.9	39.3	843.3	505.2	251.7	96.2	57.9	35.6	54.1	28.8	7.1	0.97	0.62	0.21
3 Full Speed, No Load, and First Sync	1		1	296.3	16.9	16.0	609.7	245.8	231.4	56.0	35.0	33.0	36.6	2.7	2.6	0.58	0.03	0.06
4 Emission/Pulsation Tune		1	1	429.2	224.7	38.0	841.4	493.3	248.6	96.0	57.1	35.3	52.0	24.0	4.5	0.89	0.43	0.10
5 Low Load		1	1	419.9	172.5	22.8	835.5	464.3	239.5	95.5	54.0	34.4	51.3	20.6	3.3	0.87	0.35	0.07
6 Steam Blows (with duct firing)	1	1		430.3	226.9	39.3	847.9	509.7	256.2	98.8	60.5	38.2	55.2	29.8	8.1	1.01	0.66	0.24
7 Condenser Bypass Test (no duct firing)	1	1		430.3	226.9	39.3	843.3	505.2	251.7	96.2	57.9	35.6	54.1	28.8	7.1	0.97	0.62	0.21
8 STG Commissioning	1	1	1	429.7	225.9	38.7	843.0	504.6	251.4	96.1	57.7	35.5	53.1	27.0	6.0	0.92	0.53	0.16
9 Power Train Optimization & Tuning		1		429.9	226.2	38.8	843.1	504.8	251.5	96.1	57.7	35.5	53.4	27.6	6.3	0.94	0.56	0.17
10 Full Load Performance and CEMS Cert.		2	1	430.3	226.9	39.3	843.3	505.2	251.7	96.2	57.9	35.6	54.1	28.8	7.1	0.97	0.62	0.21
with duct firing				430.3	226.9	39.3	847.9	509.7	256.2	98.8	60.5	38.2	55.2	29.8	8.1	1.01	0.66	0.24
11 Full Load Rejection Testing		1	1	430.3	226.9	39.3	843.3	505.2	251.7	96.2	57.9	35.6	54.1	28.8	7.1	0.97	0.62	0.21
with duct firing			1	430.3	226.9	39.3	847.9	509.7	256.2	98.8	60.5	38.2	55.2	29.8	8.1	1.01	0.66	0.24
12 Full Load Run Back	1	1	1	430.3	226.9	39.3	843.3	505.2	251.7	96.2	57.9	35.6	54.1	28.8	7.1	0.97	0.62	0.21
with duct firing			1	430.3	226.9	39.3	847.9	509.7	256.2	98.8	60.5	38.2	55.2	29.8	8.1	1.01	0.66	0.24

Startup Task	**Steady State Operation** Average CTG Load	NOx lb/hr	CO lb/hr	VOC lb/hr	PM10 lb/hr	SO2 lb/hr	Total Hrs of Operation	**TOTAL EMISSIONS** NOx lb	CO lb	VOC lb	PM10 lb	SO2 lb	**Mbtu (LHV) heat consumption (total per startup task)** CTG@steady state	CTG startup	Duct Burner	Total	**HRSG Stack (Steady State)** Flow, lb/h	Temp, F
1 First Fire	10%	159.09	200.00	4.31	100.00	0.31	3	774	1210	69	337	2	1,470	2,980	-	4,450	2,426,000	207
2 Install SCR Catalyst	0%	10.65	6.41	1.89	18.00	0.95	0	227	505	58	29	1	-	1,970	-	1,970	2,420,000	220
3 Full Speed, No Load, and First Sync	10%	159.09	200.00	4.31	20.00	0.31	8	1585	2441	123	199	3	3,910	4,070	-	7,980	2,426,000	207
4 Emission/Pulsation Tune	40%	6.73	178.16	9.18	20.00	0.52	8	317	2167	166	189	5	6,620	3,060	-	9,680	2,448,000	191
5 Low Load	20%	192.14	77.77	13.64	20.00	0.38	4	964	1015	143	104	2	2,410	3,060	-	5,470	2,433,000	199
6 Steam Blows (with duct firing)	100%	10.65	19.41	11.15	28.83	1.26	110	1828	3492	1386	3256	140	165,550	4,950	30,800	201,300	3,421,000	206
7 Condenser Bypass Test (no duct firing)	100%	10.65	6.41	1.89	18.00	0.95	10	764	1413	173	263	11	15,050	4,950	-	20,000	3,396,000	210
8 STG Commissioning	70%	8.69	5.08	1.58	18.00	0.73	72	1320	1965	303	1382	54	83,980	6,040	-	90,020	2,611,000	187
9 Power Train Optimization & Tuning	80%	9.34	5.51	1.68	18.00	0.80	40	600	725	125	748	33	51,170	1,970	-	53,140	2,794,000	190
10 Full Load Performance and CEMS Cert.	100%	10.65	6.41	1.89	18.00	0.95	327	3975	3357	769	5951	312	492,140	5,040	-	497,180	3,396,000	210
with duct firing	100%	10.65	19.41	11.15	26.83	1.26	40	426	776	446	1073	50	60,200	-	11,200	71,400	3,421,000	206
11 Full Load Rejection Testing	100%	10.65	6.41	1.89	18.00	0.95	3	298	776	99	90	4	4,520	3,060	-	7,580	3,396,000	210
with duct firing	100%	10.65	19.41	11.15	26.83	1.26	3	71	314	72	89	4	4,520	1,090	840	6,450	3,421,000	206
12 Full Load Run Back	100%	10.65	6.41	1.89	18.00	0.95	5	750	1632	199	180	7	7,530	6,040	-	13,570	3,396,000	210
with duct firing	100%	10.65	19.41	11.15	26.83	1.26	3	71	314	72	89	4	4,520	1,090	840	6,450	3,421,000	206
Per Turbine Total								13,968	22,103	4,202	13,977	631	903,590	49,370	43,680	996,640		
Total Hrs of Operation							**636**											

The emissions estimates shown in the table above are based on Black & Veatch estimates of 7FA gas turbine performance during transient operation, on typical 1x1 combined cycle plant start-up curves, and plant start-up procedures for Black & Veatch projects. The estimates cannot be guaranteed.

The first month of the commissioning phase is passed after Task 8.

Total start-up emissions during transient operation are defined as uncontrolled emissions from zero load to the average CTG load as indicated in the table for steady state operation.

Ambient temperature for steady state operation is assumed to be 95°F.

Emission estimates do not include cooling tower or emergency generator.

Due to the frequent transient operation of the plant during comissioning the estimate of exhaust flow and exhaust temperature can only be represented by the exhaust temperature at the average load at steady state conditions. The actual exhaust conditions at the stack may vary by +/- 30%.

Technical Area: Air Quality

Data Request 9 Rev: During the November 13, 2001 CEC Data Request Workshop CEC staff requested clarification on the VOC limit under non-duct firing and duct firing conditions.

Response: As noted in the AFC the project will meet a VOC limit of 2 ppm (@15% O_2 1-hour rolling average) when duct firing operations are not occurring. This is consistent with other non-duct fired certified projects. In the November 5, 2001 data responses the applicant subsequently agreed to a limit of 3.6 ppm based on 15 % O2. Upon further analysis, the project proposes to meet a 2 ppm VOC limit under all operating conditions. The applicant is concerned that this limit may be difficult to achieve under non-steady conditions and due to the low limits proposed for all pollutants. However, the applicant is willing to accept a permit limit of 2 ppm VOC under all operating conditions.

Revised emissions estimates utilizing the 2 ppm VOC value are attached in Table AQ-5

TABLE AQ-5

Offset Calcuations for the Worst-Case Month

Basis

	NOx, CO, VOC	
	Days per month	30
	Hours per day of duct firing	12
	Hot-starts per week	1
	Warm-starts per week	1
	Shutdowns per week	2

Duct firing (Siemens WH @ 95 F)
Non-duct firing (Siemens WH @ 41 F)

	PM10, SO2	
	Days per month	30
	Hours per day of duct firing	12
	Hours per day of non-duct firing	12
	Hours per year of duct-firing	1000
	Hous per week of boiler operations	3

Given:

Hot-start duration	1.5 hrs
Warm-start duration	2.1 hrs
Shutdown duration	0.5 hrs

Emission Rates

Source	Pollutant	Duct Firing (lb/hr)	Non-Duct Firing (lb/hr)	Hot Start (lb/event)	Warm Start (lb/event)	Shutdown (lb/event)
CT	NOx	18.1	13.7	34.5	48	25
CT	CO	10.99	8.3	428	300	120
CT	VOC	5.19	2.83	30	20	17
CT	PM10[1]	18	12	- -	- -	- -
CT	SO2[1]	1.47	1.12	- -	- -	- -
CL-TWR	PM10	NA	0.395	- -	- -	- -

[1] Hourly mass emission rates for PM10 and SO2 during startups are less than the hourly emission rates for non-startup scenarios. Emissions estimates for PM10 and SO2 do not include the effects of startups.

Boiler Emissions

Pollutant	(lb/hr)
NOx	0.224
CO	0.221
VOC	0.020
PM10	1.07
SO2	0.0036

TABLE AQ-5

Monthly Emissions Calculations

NOx, CO, VOC

Hours per month for hot-starts	6.0 hrs
Hours per month for warm-starts	8.4 hrs
Hours per month for shutdowns	4.0 hrs
Hours per month for duct-firing	360.0 hrs
Hours per month for non-duct firing	341.6 hrs
Hours per month for aux boiler	12.0 hrs

Monthly Emissions

Pollutant	CL-TWR (lb/mo)	Duct Firing (lb/mo)	Non-Duct Firing (lb/mo)	Hot-Start (lb/mo)	Warm-Start (lb/mo)	Shutdown (lb/mo)	Boiler (lb/mo)	Total (lb/mo)	Avg (lb/day)
NOx	- -	6516	4680	138	192	200	2.688	11729	391
CO	- -	3957	2836	1712	1200	960	2.652	10668	355.6
VOC	- -	1869	967	120	80	136	0.24	3172	105.7

PM10, SO2

Hours per month for hot-starts	- -
Hours per month for warm-starts	- -
Hours per month for shutdowns	- -
Hours per month for duct-firing	360.0 hrs
Hours per month for non-duct firing	360.0 hrs

Monthly Emissions

Pollutant	CL-TWR (lb/mo)	Duct Firing (lb/mo)	Non-Duct Firing (lb/mo)	Hot-Start (lb/mo)	Warm-Start (lb/mo)	Shutdown (lb/mo)	Total (lb/mo)	Avg (lb/day)
PM10	285	6480	4320	- -	- -	- -	11085	369.5
SO2	- -	530	404	- -	- -	- -	934	31.1

Boiler emissions not included for monthly emissions. Worst-case PM10 and SO2 emissions assume continuous turbine operations.

TABLE AQ-5

Annual Emissions

Hours of duct firing per year	1000
Hours of non-duct firing per year	7083
Number of hot-starts per year	52
Number of warm-starts per year	52
Number of shut-downs per year	104
Number of boiler operations per year	156

Pollutant	CTWR (lb/yr)	Duct Firing (lb/yr)	Non-Duct Firing (lb/yr)	Hot-Start (lb/yr)	Warm-Start (lb/yr)	Shutdown (lb/yr)	Boiler (lb/yr)	Total (lb/yr)	Total (ltons/yr)
NOx	- -	18100	97037.1	1794	2496	2600	34.944	122062	61.03
CO	- -	10990	58788.9	22256	15600	12480	34.476	120149	60.07
VOC		5190	20044.89	1560	1040	1768	3.12	29606	14.80
PM10[1]	3287.19	18000	93120	- -	- -	- -	166.92	114574	57.29
SO2		1470	8691.2	- -	- -	- -	0.5616	10162	5.08

[1] Cooling tower assumed to operate 8322 hours.

8322.2

Technical Area: Air Quality

Data Request 10 Rev: During the November 13, 2001 Data Responses workshop CEC staff requested clarification on the projects ability to satisfy a limit of 2.0 ppm NOx on a one-hour average under non-steady state conditions.

Response: The current achieved in practice BACT for F-class turbines is 2.0 ppm NO_x @ 15% O_2 over a 3-hour averaging period based on a 10 ppm ammonia slip. While other certified projects may have accepted limits based on 1-hour averaging time, none of these units are currently operational. Further, the MPP will be required to satisfy a stringent ammonia slip of 5 ppm. NO_x and ammonia slip are inversely proportional, therefore in order to meet the ammonia limit of 5 ppm it is anticipated it may be difficult to meet 2 ppm on a 1-hour rolling average under transient conditions. However, the Applicant is willing to accept 2 ppm on a 1-hour rolling average under steady state operations. For further clarification, it is anticipated that the 2 ppm limit will apply under non-steady state conditions (excluding start-up and shutdown) although the applicant has reservations regarding the ability to satisfy this standard with such a short averaging time.